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*THE ORGANIZATION AND ADMINISTRATION OF NATIONAL ENGINEERING SOCIETIES.**

THE most important factors in promoting the advance of the engineering profession and in disseminating and rendering available to the world the valuable experience and data accumulated by engineers in the practise of their profession, are the professional associations of national engineering societies. The importance of the interchange of data and results of observation and experience was recognized by engineers long before the practise of engineering had been exalted to the dignity of a profession.

While military engineering was recognized from the earliest times and great military engineers such as Vauban, and bridge and highway engineers such as Perronet, had achieved eminence, it was manifestly impracticable for military officers to organize for the purpose of interchange of information, on the very secrecy of which the military establishments of nations were dependent for their offensive and defensive efficiency. The first important step in the association of engineers into a professional body was taken when in 1828 Thomas Telford, in the name of 156 of his colleagues—some of whom had already formed a society as early as 1818—applied for royal charter for the Institution of Civil Engineers (of Great Britain). The original charter recites that the body is formed "for the general advancement of mechanical science, and more particularly for promoting the

* Presidential address, American Institute of Electrical Engineers, twenty-second annual convention, Asheville, N. C., June 19, 1905.

acquisition of that species of knowledge which constitutes the profession of a civil engineer, being the art of directing the great sources of power in nature for the use and convenience of man, as the means of production and of traffic in states both for external and internal trade, as applied in the construction of roads, bridges, aqueducts, canals, river navigation, and docks, for internal intercourse and exchange, and in the construction of ports, harbors, walls, breakwaters and lighthouses, and in the art of navigation by artificial power for the purposes of commerce, and in the construction and adaptation of machinery, and in the drainage of cities and towns."

It will be seen that this famous definition of the field covered by the profession of the civil engineer, as formulated by Telford, covers broadly all of the branches of modern engineering science, excepting military engineering, and includes within its scope directly or by implication mechanical, mining, electrical and sanitary engineering and naval architecture. It was not long before important discoveries in the realm of physical science and epoch-making inventions and improvements in the mechanical arts opened new fields of industrial activity, and we find this broadening of the field covered by the engineer reflected in a differentiation of the profession, in Great Britain resulting in the organization in 1847 of the Institution of Mechanical Engineers, in 1869 of the Iron and Steel Institute, and in 1871 of the Society of Telegraph Engineers and Electricians, which became in 1889 the Institution of Electrical Engineers.

Coming now to our own country, the American Society of Civil Engineers was organized in 1852, the American Institute of Mining Engineers in 1871, the American Society of Mechanical Engineers in 1880 and the American Institute of Electrical Engineers in 1884. While these are the distinctively national engineering societies, there are other technical associations like the Society of Naval Architects and Marine Engineers, the American Society of Heating and Ventilating Engineers, the American Street Railway Association, Association of Engineering Societies, etc., which, although of national importance, do not come within the scope of our subject.

There are still many other professional bodies in the United States identified with the engineering profession, some of a national character, which in addition to professional activities are also associated for commercial relations and whose memberships consist largely of business corporations, such as the National Electric Light Association and the Association of Edison Illuminating Companies, and still others largely local in character, such as the Pacific Coast Transmission Association, the Engineers' Society of Western Pennsylvania, and the league known as the Association of Engineering Societies, representing a total membership of 1,766 in eleven local engineers' clubs or societies.

In this review we shall confine ourselves to the four national engineering societies first referred to, with some reference to the corresponding bodies in Great Britain and on the continent.

NATIONAL ENGINEERING SOCIETIES (U. S.).

Name and Date of Organization.	Date of Report.	Hon. Members.	Full Members.	Asso. Members.	Associates.	Junior Members.	Total.
American Society of Civil Engineers, 1852	Jan. 1, 1905	9	1793	903	127	[1]367	3203
American Institute of Mining Engineers, 1871	Jan. 1, 1905	7	3483	—	190	—	3680
American Society of Mechanical Engineers, 1880	Jan. 1, 1905	19	1915		237	609	2780
American Institute of Electrical Engineers, 1884	Jan. 1, 1905	2	481	2851	—	—	3334

[1] Including 27 fellows.

The membership of these bodies, divided into the several classes according to their last official reports, is given in the following table; as a matter of general interest there is also added a tabulation of the more important European engineering societies.

FOREIGN ENGINEERING SOCIETIES.

Name and Date of Organization.	Date of Report.	Hon. Members.	Full Members.	Asso. Members.	Associates.	Total.
Institution of Civil Engineers (of Great Britain), 1818.....	Jan. 1, 1905	19	2191	4116	271	[1]6597
Institution of Mechanical Engineers, 1847.....	Mar. 1, 1905	9	2351	1545	72	[2]3977
Iron and Steel Inst., 1869.....	Jan. 1, 1905	11	1898	—	—	1909
[3]Institution of Electrical Engineers, 1889.....	Aug. 31, 1904	6	[4]1101	1435	1761	[5]4303
Verein Deutscher Ingenieure, 1891.....	Apr. 24, 1903	6	17543	—	—	17549
Société des Ingénieurs Civil de France, 1848.....	1901	—	—	—	—	3691

A study of the annual reports of these bodies from year to year and of their constitutions and by-laws is of considerable interest, showing their progressive expansion, growing influence, and higher professional standing from year to year, and the lines along which these developments take place. We will not undertake a retrospective analysis, however, but rather confine ourselves to a comparative study of the methods of organization and business administration of the four national engineering societies as revealed in their last annual reports. It should be stated at the outset that this study is not undertaken with a view of criticizing the methods followed or results accomplished by our sister societies, but for the purpose of profiting by their experience and, if possible, avoiding in our own rapidly growing body any abnormal development which may detract from its efficiency as a whole, or result in purely local development at the sacrifice of general usefulness and national standing.

One of the very first questions we encounter is that of the grades of membership, then the requirements of admission to them, and the method of election. These questions are of fundamental importance and they are worthy of the closest attention, as upon them more than upon any other feature of the organization will depend the professional standing of the society and its healthy growth in membership and influence. There is no honor within the gift of the society which requires the exercise of so much judgment, such fidelity to its interests, such conscientiousness, impartiality and impersonality, as membership on the Board of Examiners or Committee on Admissions, and it is deserving of the highest recognition.

The requirements for honorary membership demand no lengthy discussion, as the practise of all of the societies is essentially identical in this respect.

The requirements for full membership vary greatly in the four societies, as we shall see from abstracts from their constitutions.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

Constitution—Article II.—Membership.

2. A Member shall be a Civil, Military, Naval, Mining, Mechanical, Electrical, or other professional Engineer, an Architect or a Marine Architect. He shall be at the time of admission to membership not less than thirty years of age, and shall have been in the active practise of his profession for ten years; he shall have had responsible charge of work for at least five years, and shall be qualified to design as well as to direct engineering works. Graduation from a school of engineering of recognized reputation shall be considered as equivalent to two years' active practise. The performance of the duties of a Professor of Engineering in a technical school of

[1] Not including 1,114 students or graduates.

[2] Not including 450 students or graduates.

[3] Originally organized as the Society of Telegraph Engineers and Electricians in 1871.

[4] Includes 136 foreign members.

[5] Not including 1,107 students or graduates.

high grade shall be taken as an equivalent to an equal number of years of actual practise.

AMERICAN INSTITUTE OF MINING ENGINEERS.

Constitution—Article II.—Members.

Sec. 3. The following classes of persons shall be eligible for membership in the Institute, namely: As Members, all professional mining engineers, geologists, metallurgists or chemists, and all persons practically engaged in mining, metallurgy or metallurgical engineering.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Constitution—Membership.

C 9. A Member shall be thirty years of age or over. He must have been so connected with Engineering as to be competent, as a designer or as a constructor, to take responsible charge of work in his branch of Engineering, or he must have served as a teacher of Engineering for more than five years.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

Constitution—Article II.—Membership.

2. A Member shall have been an Associate, and at the time of his transfer to membership he shall be not less than twenty-seven years of age, and shall be:

a. A Professional Electrical Engineer; or

b. A Professor of Electrical Engineering; or

c. A person who has done important original work, of recognized value to electrical science.

3. To be eligible to membership, as a professional Electrical Engineer, the applicant shall have been in the active practise of his profession for at least five years; he shall have had responsible charge of work for at least two years, and shall be qualified to design as well as direct electrical engineering works. Graduation from a School of Engineering of recognized standing shall be considered the equivalent of one year's active practise.

4. To be eligible to membership as Professor of Electrical Engineering, the applicant shall have been in responsible charge of a course of Electrical Engineering at a college or technical school of recognized standing for a period of at least two years.

It will be seen that two of the societies fix an age limit of thirty years, one twenty-seven years and one fixes no limit; one requires professional practise of ten years, one five years, two no time specified; three require professional competency in designing as well as constructing or directing engineering works, one requires the applicant to be professionally or practically engaged in the branch.

In the case of the Mechanical Engineers and the Civil Engineers the election is by ballot of the membership at large after approval by the executive board or council; in the case of the Mining Engineers and Electrical Engineers, election is by direct vote of the board of directors, in the latter after submitting the names to the membership at large, in the former without submission. In the Mining Engineers, Mechanical Engineers and Electrical Engineers the application is first passed upon by a board of examiners and then by the executive board or council; in the case of the Civil Engineers by the board of directors directly without action by an examining board. The Electrical Engineers' constitution requires that all members be first elected as associates and then transferred by the board.

It will be seen from the above how different the requirements are for full membership in the several societies, and how varied the procedure for election. It would appear at first thought that the more explicit the constitution in its exact definition of the conditions for membership the easier it would be for the membership committee to act; but this is by no means always the case, as it often prevents the taking of a broad view of the candidate's eligibility and is apt to exclude desirable material on very technical grounds, although on the other hand it is a protection against loose interpretation of the requirements by careless examiners. There would seem to be a better division of responsibility and more direct control of the class of men admitted to membership by giving wide publicity to their candidacy and election

by ballot by the membership at large, after the candidates have passed the scrutiny of the board or an examining committee. A young society covering a branch of engineering that has but recently become specialized can not in the beginning impose rigorous requirements as to age limits or time of professional service and the branch of engineering may be such as to make it difficult to impose severe technical requirements.

In the case of the Civil Engineers the accepted definition is sufficiently broad to cover applicants who are professionally engaged in any of the other branches of engineering; the Mechanical Engineers' definition is somewhat less comprehensive, the Mining Engineers' still less so, and the Electrical Engineers' really restrictive to professional electrical engineers. Under our institute's constitution, however eminent a man may be as a civil, mechanical or mining engineer, he may not fulfil the qualifications of an electrical engineer. It will thus be seen that anything like standardization in the matter of requirements is wholly out of the question, although a greater uniformity in requirements and procedure for election would be advisable. It is very difficult for an applicant in every respect qualified for full membership in our institute to understand why it should be necessary for him to pass through the preliminary, or, as it were, probationary grade of associate, and then be transferred to full membership, but the constitution is clear. Applicants whose superior qualifications would entitle them to immediate election to full membership after their election to the preliminary grade of associate, which takes some time—several months at least—are apt to fail to make application for transfer, with the result that many remain in the associate grade who should certainly be transferred, and when they find the cause of the delay are apt to criticize the administration.

We now come to the consideration of the other grades of membership, associate membership, associates, juniors, etc. It would lead us too far afield to treat each grade in full and we shall confine ourselves to some general observations. It is necessary to provide one or more grades for young men just entering professional life and through which they can rise as they acquire experience to the dignity of full membership; but it is necessary to provide also for another class of men who, while they are not professional engineers, yet cooperate with them and conduct engineering works, acting as the executive heads or business managers. To such men eminent in their particular branch of activity it is humiliating to be placed permanently in an inferior grade of membership with the beginners in professional service, and the situation can be satisfactorily met by the establishment of the grade of associate; junior and associate membership then to represent successive steps in the advancement to full membership, the associates forming a class by themselves.

We now come to the question of the dues and at the same time we may, with advantage, consider the general question of the income and expenditures or the cost of conducting the business of the societies.

The expense of membership in the several societies is as follows:

	Entrance Fees.			Annual Dues.			Foreign.	
	Juniors.	Associates.	Members.	Juniors.	Associates.	Members.	Associates.	Members.
Amer. Society Civil Engineers	$10	$20–25	$30	$10–15	$10–15	$15–25		
Amer Institute Mining Engineers	—	10	10	—	10	10		
Amer. Society Mechanical Engineers	15	25	25	10	15	15		
Amer. Institute Electrical Engineers	—	5	15	—	10	15	5	10

In view of the new relations entered into between the three national engineering societies, which are to occupy jointly the Union Engineering Building, and as the societies have now roughly about the same membership, it would appear to be desirable to have membership dues as nearly on a uniform basis as practicable.

It would appear that the entrance fees of our institute might be revised without disadvantage, increasing the entrance fees for associate to at least $10 and a payment of an additional $15 on transfer, a total of $25 for full membership. An increase in annual dues also is not at all improbable in the near future, and they might with advantage be increased to $15 for resident associates (within fifty miles of New York) and to $25 for resident members; this increase for resident membership would seem to be warranted by the greater advantages enjoyed by the membership residing in or near New York, more especially after the occupancy of the Union Engineering Building.

RECEIPTS AND DISBURSEMENTS PER YEAR PER MEMBER.

Receipts.	Civil.	Mining.	Mechanical.	Electrical.
Entrance Fees	$2.59	$0.28	$2.45	$0.83
Dues	16.99	10.64	14.04	9.30
Transactions, Sales and Adv	1.86	2.09	1.64	1.70
Badges and Certificates	.65	—	—	.28
Interest	.36	.34	—	.21
	$22.45	$13.35	$18.13	$12.32
Disbursements:				
Transactions	$4.63	$5.28	$7.50	$3.77
Salaries, etc.	6.13	4.22	3.99	2.20
Meeting Expenses	.29	.30	.94	.82
Library, including Rent and Salaries	.30	.80	.39	.81
Rent	2.84	.74	2.79	.75
Stationery and Miscellaneous Printing	.62	.34	1.19	.70
Postage	1.10	1.02	.26	.66
General Expenses	.34	.47	.11	.54
Badges and Certificates	.50	—	.33	.25
Express	—	.83	—	.22
Totals	$16.75	$14.00	$17.50	$10.72
Credit Balance per Member	$5.70	$0.65 (Deficit.)	$0.63	$1.60

Let us now consider the annual receipts and disbursements per paying member per year in the four societies. These figures are presented purely as a matter of general interest and not at all of invidious comparison; the table of receipts and disbursements per member is subdivided under appropriate heads as accurately as they can be compiled.

It should be borne in mind that no deductions of value can be drawn from a mere comparison of these figures alone; take the cost of the transactions, for instance, in order to make a comparison of the relative economy with which this item is handled in the several cases, it would be necessary to know in each instance the number of pages, number of cuts, number of advance copies distributed at meetings or in monthly advance publications in addition to the regular annual volumes. The figures, therefore, represent the amounts which are being spent on the several items, rather than a comparison of their economic handling; it would be fallacious to assume that the figures necessarily represent the comparative economy with which the societies conduct the items in the table.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

RECEIPTS AND DISBURSEMENTS PER YEAR PER MEMBER.

During each fiscal year for the past five years.

Year.	1901.	1902.	1903.	1904.	1905.
Membership	1260	1549	2230	3027	3460
Receipts:					
Entrance Fees	$0.61	$1.16	$1.59	$1.65	$0.83
Dues	8.61	10.06	9.01	9.33	9.30
Transactions, Sales and Adv.	1.03	1.54	1.79	2.11	1.70
Badges	.18	.26	.35	.39	.28
Interest	.12	.24	.21	.18	.21
	$10.55	$13.26	$12.95	$13.66	$12.32
Disbursements:					
Transactions	$2 83	$3.50	$4.67	$3.43	$3.77
Salaries	2.49	2.78	2.49	2.50	2.20
Meeting Expenses	1.05	1.13	.87	1.16	.82
Rent	.94	.94	.65	.79	.75
Library, including Rent and Salaries	.55	1.85	1.38	1.39	.81
Postage	.46	.51	.69	.66	.66
Stationery, Miscellaneous Printing	.39	.53	.96	1.01	.70
General Expenses	.33	.59	.52	.45	.54
Badges	.16	.19	.27	.35	.25
Express	.15	.15	.15	.28	.22
Total	$9.35	$12.17	$12.95	$12.02	$10.72
Credit Balance per Member	$1.20	$1.09	$0.00	$1.64	$1.60

It may also be interesting to compare the receipts and disbursements per institute member during the past five years, in which the membership has increased from 1,260 to 3,460.

Our next concern is with the officers of the societies and the method of nomination and election. A truly national society should draw its membership from all parts of the country and should afford representation in its officers and on its administrative committees to the membership at large; in other words, should select its officers as far as possible with a view also to geographical distribution. It is admitted that this is difficult, owing to the opportunities afforded to practising engineers by large enterprises whose administration, technical as well as financial, is located in the important commercial centers, hence the important groups of members in the large cities. From these are drawn the majority of the officers, such selection being emphasized by the necessities of the central administration of the society. Such tendencies, however, are apt to operate to the disadvantage of available candidates for the important posts of honor within the gift of the societies who may happen to be stationed some distance away from headquarters, and to keep the institution on the plane of national standing it should also have a care to broad geographical distribution. This end can best be accomplished by providing for a nominating committee selected according to a geographical distribution into approximately equal groups of members, each geographical district consisting of, say, 300 or 400 members, and upon these, in consultation with a number of past officers, would rest the selection of the official nominees, with provision also for the filing of such nominations as may be made directly by the general membership. This procedure was introduced by the American Society of Civil Engineers several years ago. Such a plan would provide geographical representation and at the same time discourage unseemly electioneering and circularizing for the coveted posts of honor. It is thought by some that our own institute could with advantage modify its own procedure in this direction.

We would add further that the election once accomplished, the officers-elect could again, with advantage to the interests of the institute, take office at once at the close of the annual meeting, or at latest as the last act of the annual convention. The supercession of the retiring president and officers and the installation of the new should be an official function before a general institute meeting, a deficiency of our present method of procedure, which now allows four months to elapse after the election of the new officers before they actually take office, and within three months or at most four months after taking office the active canvass for their successors already begins. It will be admitted by all with experience in the administration of professional societies that it is most desirable to eliminate all tendencies to political agitation in connection with the election to the honors within the gift of the membership, concentrating all efforts on the advancement of the professional standing of the society and the interests of its members. It would also seem to be of advantage to have the fiscal year coincident with the calendar year; this would bring the annual meeting less close to the annual convention and, spreading it over several days, would secure a larger attendance of the out-of-town membership for the annual business meeting and the annual banquet or other functions could be held at this time. The annual meeting as held at present is not markedly distinguished from the other monthly meetings, and there is usually only

a month between it and the annual convention. With the growing importance of the financial interests confided to the care of the successive administrations the yearly business meeting should have larger attention and participation from the membership at large than is the case at present.

The administration of the societies should be in the hands of their board of directors or councils, and similarly the important standing committees in whose hands rests the conduct of the routine in the several branches of administration should be committees of the board or council. Such being the case, it is desirable that their appointment should in the beginning rest with the board itself, one member of each standing committee retiring each year and the new president filling the vacancies, a much more satisfactory arrangement than the plan followed by our institute at present, under which the responsibility of the appointment of all the committees, standing as well as special or temporary, rests alone with the president. The suggested plan of appointment of the administration committees primarily by the board or council, the president filling the vacancies that occur each year, is not the one usually followed by our national societies, but even where all the appointments devolve on the president alone, membership on the standing committees is, as a rule, limited to members of the board. The advantage of selecting the standing committees from the members on the board is evident, as the committees are then not apt to follow a policy at variance with the wishes of the executive body, disturbing harmonious relations and continually raising questions of jurisdiction.

It is also desirable to avoid constant changes in the personnel of such important committees as the finance, library and membership committees; provision should be made for standing committees of three or five, with one member retiring each year, the new members to be appointed by the incoming president. Such a plan secures continuity of policy, gives the committees the benefit of accumulated experience and relieves the president of the responsibility of making such a large number of new appointments on entering his term of office. Such standing committees as finance, membership, library, publication and meetings, or the last two consolidated into one, are necessary for all societies, together with such other committees as the particular field covered by the work of the society may require. Outside of the standing committees required by the regular routine, it is desirable to avoid as far as practicable the appointment of special or temporary committees, and these, when the special work assigned to them has been performed, should be discharged. There is nothing more subversive of effective and energetic administration than board meetings at which an interminable series of committees make 'no report' or the chronic 'report of progress.'

In case it is considered advisable to appoint a separate 'committee on meetings' or 'papers and meetings' and a 'committee on publications' or 'editing committee'—a division of work which becomes necessary when monthly meetings are held with reading of papers and discussions, as well as one or more annual meetings—it becomes necessary to define their respective responsibilities very clearly, placing upon the committee on meetings or papers the responsibility of the acceptance of the paper or communication for presentation at the meeting, and upon the publication or editing committee alone the responsibility for the publication of the paper or discussion, as a whole or in part, in the official transactions of the society.

It might be observed here that great care

should be exercised in the conduct of a society occupied with a specific branch of engineering, that as far as practicable all of its divisions receive due consideration. In an institute of electrical engineering, telegraph and telephone, electric traction and electric lighting, central station and isolated plant, transmission and distribution, design and construction, theory and practise, in fact all branches of electrical engineering, should receive consideration, and in the solicitation of papers for the series of meetings held during the year a wide range of subjects should be covered so as to interest and attract the largest circle of members.

We have already referred to the importance of conducting a national society on broad lines so that the members at large should have a share in the benefits as well as the obligations of membership, whether they be located near the headquarters of the society or at a distance. It is manifest that when the monthly meetings, as well as the more important annual functions, are held at the headquarters of the society, the members at a distance feel that they are at a disadvantage, and there is a tendency to form local clubs or organizations and secede from the parent society or at least lose interest in it. Our institute has met this situation courageously, and through the initiative of Past-president Scott a series of local organizations was established and they have been added to under succeeding administrations; these organizations have done much to keep up the interest at distant points and they have undoubtedly induced desirable accessions to our membership and have been an important stimulant of professional activity.

Our sister societies are facing the same problem and are watching the result of our undertaking—it can no longer be called an experiment—with great interest. But this scheme of local organizations, while undoubtedly successful, is developing new problems and new conditions and requires the constant care and supervision of the central administration.

As the close of another administrative year draws near I have felt it incumbent upon myself, and the fulfilment of a duty, to direct your attention to some of the questions which are before us and to give expression to a few thoughts that have occurred to me as a result of some years' experience in connection with the administrative work of our own society and a study of the methods followed by our sister engineering societies.

The comparisons which have been presented and the suggestions offered are not made in a spirit of criticism, nor am I unmindful of the splendid work accomplished by the framers of our present constitution, to whom the highest credit is due for an altogether excellent compilation, but our institute is growing rapidly and with its expansion new problems are arising, its field of activity is constantly broadening, and it should be expected, therefore, that modifications in its organic law may from time to time become necessary.

It is in meeting and solving such new problems of society administration as I have referred to, that the youth and enthusiasm of our members are of the utmost advantage; we are less handicapped by precedent and tradition than some of our older sister societies, and we may, therefore, expect for the Institute of Electrical Engineers a glorious future full of activity, initiative and prosperity, and successful in the attainment of the highest professional standing, dignity and usefulness.

JOHN W. LIEB, JR.

THE THIRTY-SECOND GENERAL MEETING OF THE AMERICAN CHEMICAL SOCIETY, HELD AT BUFFALO, N. Y., JUNE 22-24.

OPENING SESSION.

An address of welcome was delivered by President T. Guilford Smith, of the Buffalo Society of Natural Sciences, and the response by Francis P. Venable, president of the Chemical Society. An address on 'The Classification of Carbon Compounds,' by Professor Marston T. Bogert, and one on 'Some Recent Advances in Physiological Chemistry,' by Professor John H. Long, followed. It is probable that both of these addresses will be published later. The following papers were presented:

Note on the Atomic Weight of Carbon: Charles L. Parsons.

As the analyses made during the determinations of the atomic weight of beryllium were of two compounds containing exactly the same elements, two simultaneous equations were obtained which would yield the atomic weights both of beryllium and of carbon, each entirely independent of the other. The calculation gave the figure 12.007 for carbon and 9.112 for beryllium, which is highly confirmatory of the correctness and accuracy of the work on beryllium published in the *Jour. Am. Chem. Soc.*, **26**, 721.

Chemical Glassware: Percy H. Walker.

A series of tests for durability and solubility of beakers and flasks, with analyses and tests of a number of different glasses, was reported upon. The zinc borosilicate glasses are distinguished by permanent trade marks, and are much more resistant to changes of temperature, less soluble in water and carbonated alkalis, but somewhat more soluble in caustic alkalis, than the alkali-lime silicate glasses. The zinc borosilicate glasses are generally of good quality, but much of the alkali-lime silicate glass on the market is very poor.

An Apparatus for Determining the Viscosity of Liquids at Different Temperatures, and *An Apparatus for Determining the Flash-point of Inflammable Liquids:* F. Courtois.

These pieces of apparatus are described and illustrated in the *Scientific American,* May 20, 1905 (p. 408). One of the main features of the flash-tester is the uniformity of level insured by an overflow compartment.

MEETINGS OF THE SECTIONS.

During part of the time the society met in the form of sections, before which most of the papers were read. These were: Section of General and Physical Chemistry, Willis R. Whitney, chairman; Section of Organic Chemistry, Marston T. Bogert, chairman; Section of Agricultural, Physiological and Sanitary Chemistry, John H. Long, chairman; Section of Inorganic Chemistry, L. M. Dennis, chairman. The papers read were:

Vapor Pressure of Sulphur at 100° C.: Hippolyte Gruener.

Dry carbon dioxide, hydrogen and air were passed over sulphur heated to 99°.80 C., saturation of the gas being assured. The sulphur volatilized was collected on the walls of a detachable tube and thus weighed. The results from these gases agreed within 5 per cent., and the vapor pressure calculated from the mean, for S_8, is 0.00718 mm. For 70°, 80° and 90° the vapor pressures are 0.00061 mm., 0.00156 mm. and 0.00287 mm., respectively.

Confirmatory results were obtained by boiling water with sulphur and weighing the sulphur carried over by the escaping steam.

On a New Dynamic Method of Measuring Vapor Tensions of Solutions: Louis Kahlenberg.

This method consists in slowly drawing a known volume of air *over* the liquid whose vapor tension is to be measured, the liquid being placed in a large horizontal glass tube which is constantly agitated to insure complete saturation of the air with the vapor, but not so as to produce spray. The material thus carried over by the air is absorbed in appropriate apparatus and weighed. In the case of solutions a measurement is also made with the pure solvent.

Apparatus for Vapor Heating: H. R. CARVETH and J. P. MAGNUSSON.

The paper reviews the various forms of apparatus which have been suggested for the determination of molecular weights by the vapor heating method and presents a new form. Its distinguishing feature is that while it still permits of the return of the condensed liquid to the boiling flask the latter, being separate from the vapor heater, may in case of breakage be readily replaced.

Tensile Strengths of Aluminum Zinc Alloys: W. D. BANCROFT.

A New Use for the Dilatometer: W. LASH MILLER.

The Hydrolysis of Ammonium Acetate and the Ionization of Water at High Temperatures (100°–156°): ARTHUR A. NOYES and YOGORO KATO.

The figures below are computed from conductivity measurements made with a specially constructed apparatus previously described. Percentage hydrolysis of ammonium acetate at one one-hundredth normal (values vary but slightly with concentration): at 18°, 0.5 per cent.; at 100°, 5.2 per cent.; at 156°, 17 per cent. Ionization constants:

	Water.	Acetic Acid.	Ammonium Hydroxide.
18°	0.66×10^{14}	18.3×10^{5}	17.1×10^{5}
100	48 "	11.4 "	14.0 "
156	155 "	5.6 "	6.6 "
218	200 "	1.9 "	

It will be noticed that the increase in the constant of water and the decrease in those of the acid and base act together in producing increased hydrolysis at high temperatures.

Equilibrium in the System, Beryllium Oxide—Oxalic Acid—Water: CHAS. L. PARSONS and W. O. ROBINSON.

Equilibrium studies of the oxalates of beryllium show that the basic oxalates which have found their way into chemical literature have no basis in fact, but are solid solutions of indefinite composition. The acid oxalate of beryllium also can not be made. The one definite compound of these three components is $BeC_2O_4 + 3H_2O$ at ordinary temperature and $BeC_2O_4 + H_2O$ obtained by heating the first to 100°.

The Phosphates of Calcium: F. K. CAMERON.

In the system $Ca—Po_4—H_2O$, the equilibrium is reached at 25° C. at a slow rate. The ratio PO_4/Ca in the solid phase was found to be 4.6 at a concentration of Ca above 55 grams, and of PO_4 above 423 grams, per liter of solution. Between this point and the second point, whose exact position is still under investigation, the ratio PO_4/Ca in the solid phase was 2.4. At lower concentrations of PO_4 the ratio PO_4/Ca in the solid phase varied continuously from about 2.1 to 0. This shows that at higher concentrations the solid phase is monocalcium phosphate; at intermediate concentrations the solid phase is dicalcium phosphate, and at lower concentrations there is one, or possibly two, series of solid solutions.

The Transmutation of the Elements: H. J. BARNES.

A Strong, Sterilizable, Dialyzing Membrane: H. W. HILL.

Some Notes on Rock Decompositions: ALLERTON S. CUSHMAN.

In studying the action of water on rock powders, the principles of electrolysis and electrical endosmosis were resorted to, since on simple extraction and filtration the insoluble colloid or 'pectoid' decomposition products retain the alkalis. These investigations are as yet unfinished, but it is hoped by this means to study the actual kaolinization of the feldspars in the laboratory. It is also hoped that the determination of the endosmotic constant, according to Wiedermann's formula, of different rock powders will furnish a means of accurately ascertaining the relative rate of decomposition under the action of water.

Some Observations on the Deposition of Alloys from Mixed Solutions: C. B. Jacobs.

In studying the simultaneous deposition of two metals from a mixed solution of their salts, the author found that the difficulty of preventing the solution from attacking and dissolving the more electropositive metal after deposition could be overcome by the use of two anodes, one of the electropositive metal and one of the electronegative metal, connected to separate generators running at different voltages, the current returning through the cathode in the bath by a common third leg to the generators. Alloys of zinc and nickel and of zinc and copper were deposited in this manner from neutral sulphate solutions. With cyanide solutions of copper and zinc a great variety of brass work was plated from the same bath by changing the voltage on either anode, so as to deposit a brass running high in copper and low in zinc, or *vice versa*.

Some Properties of the Metal-Ammoniums: C. A. Kraus.

A study was made of the conductivity and of the conductivity temperature coefficient of the metal-ammonium solutions, from which it develops that the properties of these solutions are very different from those of salt solutions in ammonia. Migration experiments were carried out which show that a metal-ammonium solution may behave like a metallic electrode. The process of solution of a metal in ammonia is not accompanied by electromotive forces. The bearing of the optical properties on the problem of the metal-ammoniums was briefly pointed out.

A Determination of the Coefficient of Expansion of Oxygen: Edward W. Morley and Dayton C. Miller.

The method employed is a differential one, in which two globes, both filled with hydrogen, are connected to a differential manometer, and the difference of pressure of the gas in the two globes is measured at zero and at one hundred degrees, the manometer being at a constant temperature. Oxygen is then put in one of the globes, and by means of the differential manometer the expansion of the oxygen is compared with that of the hydrogen which previously filled the *same* globe. A value obtained some time ago was not final, since the glass of the globes would not endure repeated exposure to steam.

With the present apparatus, a value has been secured which is not subject to much uncertainty. The coefficient of expansion of hydrogen as determined by the *Bureau International des Poids et Mésures* being 0.00366,254, the value of the authors for the coefficient of expansion of oxygen is 0.00367,00.

The Isolation and Properties of Some Electro-Positive Radicals: C. A. Kraus. (By title.)

On the Solubility and Specific Rotatory Power of Carbohydrates and Various Organic Acids and Bases in Pyridine and Other Solvents: J. G. Holty.

Pyridine, the solvent chiefly used in the

experiments, dissolves most of the substances studied except starch and some of the dextrins. Its effect upon their specific rotatory power is marked, decreasing it in some cases and increasing it in others. Rock candy in particles of various assorted sizes gave, with pyridine, solutions of the same concentration.

On the Relation between the Electrolytic Conduction, Specific Inductive Capacity, and Chemical Activity of Certain Liquids: J. H. MATHEWS.

From a study of the dielectric constants of various solvents, as alkyl silicates, mustard oils, pyridine, carbon tetrachloride, etc., and also of solutions made with the same, the conclusion is drawn that this value can not be considered an additive one. Certain acids dissolved in the mustard oils give non-conducting solutions, though retaining their acid characteristics, and alkaloids and amines also yield non-conducting solutions. Addition of water to a solution of trichloracetic acid in benzene produces, up to one tenth of a per cent., very little increase in the conductivity. The work is regarded as an argument against a relation between chemical action and electrolytic phenomena.

Dineric Equilibria: W. D. BANCROFT.

The Proximate Composition and Physical Structure of Trinidad Asphalt: CLIFFORD RICHARDSON.

The material, amounting to six per cent. or over, that remains undetermined in the ordinary proximate analysis is found to consist of volatilized inorganic salt, water of hydration from the clay, and absorbed bitumen. A complete analysis is as follows:

The mineral matter is the residue from the disintegration of granitic rock and consists largely of clay. The hydrocarbons and nitrogen compounds correspond to those found in California petroleum.

	Crude Asphalt.	Crude Asphalt Dried.
Water and gas	29.0%	
Bitumen soluble in hot chloroform	39.7	56.0%
Bitumen adsorbed by clay	.7	1.0
Mineral matter on ignition with tricalcium phosphate	27.3	38.5
Water of hydration in clay	3.3	4.5
	100.0	100.0

Studies on Phosphate Absorption by Soils: OSWALD SCHREINER.

The author is studying the absorption of phosphates by different soil types, obtaining a curve of absorption and then continuing the work by washing out the absorbed phosphates when a maximum absorption has taken place, thus obtaining the washing-out curve. He finds that the absorption curve is much steeper than the washing-out curve and that the absorbed phosphates are washed out much more slowly than they are absorbed, yielding solutions which are very nearly constant in phosphate content, in the case of any given soil type. Both the absorption curve and washing-out curve are different for different soil types and appear to be characteristic of the type. The absorbed phosphates are readily removed by electrolysis in porous cells.

Laboratory Methods for Studying the Formation of 'Alkali': F. K. CAMERON.

An account of methods used in the chemical laboratory of the Bureau of Soils for studying the formation, movement and accumulation of the different types of 'alkali' found in soils in the arid regions of the west.

Electro Double Refraction: HOWARD L. BLACKWELL.

The Action of Ethylene Dibromide on p-Nitrosodialkylanilines, II.: HENRY A. TORREY.

When ethylene dibromide and *p*-nitrosodimethylaniline are heated together at 80°–90°, the following reaction occurs:

$$4C_6H_4N(CH_3)_2NO + C_2H_4Br_2 = [C_6H_4(NO)N(CH_3)_2]C_2H_2 + 2C_6H_4(NO)N(CH_3)_2HBr.$$

That is, the hydrobromide of nitrosodimethylaniline and a base formed from the union of two molecules of dimethylaniline and the acetylene group are produced. The base is proved to be tetramethyldiamidoglyoxine N-phenyl ether,

$$(CH_3)_2NC_6H_4-N(O)-CH-CH-N(O)-C_6H_4N(CH_3)_2.$$

The reaction can best be interpreted by the assumption of the formation of an intermediate addition product, from which hydrobromic acid splits off easily. Diethylaniline gives an analogous reaction.

On the Preparation of Various Acyl Derivatives of Dimethyl 4-Amino-o-phthalate: M. T. Bogert and R. R. Renshaw.

On Some Nitro and Amino Derivatives of Fluorescein (preliminary notice): M. T. Bogert and R. G. Wright.

Researches on Pyrimidines: On 2, 5-Diamino-6-oxypyrimidine: Treat B. Johnson.

The True Benzaldehyde-azo-benzoic Acids: Frederick J. Alway.

The Neutral Sulphite Method for Determining Aldehydes in Essential Oils: S. S. Sadtler.

The Detection and Determination of Ethyl and Methyl Alcohols in Mixtures by the Immersion Refractometer: Albert E. Leach and Hermann C. Lythgoe.

The strongest commercial ethyl alcohol (91 per cent. absolute alcohol by weight) gives a reading with this instrument of 98.3° at 20° C., while the reading of methyl alcohol of 91 per cent. strength by weight is 14.9°. Fifty per cent. ethyl alcohol by weight has a reading of 90.3°, while the same strength (50 per cent.) of methyl alcohol reads 39.8°, all readings being made at 20° C.

The detection of wood alcohol by this method is simple and consists in submitting to refraction the distillate which one makes for the determination of ethyl alcohol in the regular manner in beverages, essences, tinctures, extracts or whatever may be the nature of the samples to be examined. If the refraction of the liquid shows the percentage of alcohol agreeing with that obtained from the specific gravity in the regular manner, it may safely be assumed that no methyl alcohol is present. If there is an appreciable amount of methyl alcohol, the low refraction will indicate the fact.

Not only can methyl alcohol be thus readily detected, but the amount may be determined, since addition of methyl to ethyl alcohol decreases the refraction in direct proportion to the amount present.

A Comparison of Methods for the Determination of Fusel Oil: E. M. Chace and W. L. Dubois.

The general scope of the paper is limited to the description and comparison of the Roese and Allen-Marquardt methods, no satisfactory results having been obtained by the colorimetric method. The basis of the Allen-Marquardt method is the separation of the higher alcohols by extraction from brine with carbon tetrachloride, their oxidation to the corresponding volatile acids by acid bichromate solution and their final titration after distillation. It is regarded by the authors of the paper as long and tedious, but more accurate than the Roese method.

A Crucible Method for the Determination of Sulphur, Halogens and Phosphorus in Organic Substances: S. S. Sadtler.

Methods for Examinations of Cellulose Nitrate and Smokeless Powders: Albert P. Sy.

For purposes of classification and naming it is proposed to divide cellulose nitrates (as the nitration products of cellulose are correctly called) into two classes, ether-alcohol soluble, and ether-alcohol insoluble. Each product in each of these classes is then designated according to its nitrogen content expressed in percentage of dry material. After a brief description of cellulose nitrate manufacture, the methods for examination were summarized as follows: (1) Stability tests: potassium-iodide-starch test, German 135° C. test, ordnance department 115° C. test. (2) Analysis: moisture, nitrogen, soluble (ether-alcohol), insoluble (ether-alcohol), soluble in acetone, cellulose, ash, alkalis. (3) Physical examination: compression test, microscopical tests.

Camphoroxalic Acid Derivatives: J. BISHOP TINGLE and WILLIAM E. HOFFMAN, JR.

The condensed formulæ $AgHC_4O_4C_8H_{14}$, $CuC_4O_4C_8H_{14}$ and $Fe(HC_4O_4C_8H_{14})_3$ represent three types of metallic salts prepared. With amines representatives of four types of compounds have been prepared and their properties and constitution studied; there is also a fifth class the constitution of which is uncertain. The amines from which the above-mentioned compounds were prepared were: *a*-naphthylamine, *β*-naphthylamine, *p*-toluidine, *m*-toluidine, benzylamine, diethylamine, dimethylamine, methylamine, *o*-phenylenediamine, benzidine, nitrotoluidine, semicarbazine, benzamidine, phenylhydrazine. Certain other amines gave negative or unsatisfactory results.

Rosocyanine: C. LORING JACKSON and LATHAM CLARKE.

Rosocyanine has the same percentage composition as curcumine. Its relation to curcumine was discussed.

The Formula of Curcumine: C. LORING JACKSON and LATHAM CLARKE.

The older formula $C_{14}H_{14}O_4$ is shown to be in harmony with the analyses and is supported by a determination of the molecular weight.

The Reduction of 5-Nitro-4-ketodihydroquinazolines to the Corresponding Aminoquinazolines, and the Preparation of Certain Derivatives of the Latter: M. T. BOGERT and V. J. CHAMBERS.

The Synthesis of 5-Nitro-4-ketodihydroquinazolines from 6-Nitroacetanthranil and Primary Amines: M. T. BOGERT and H. A. SEIL.

On Isomeric O and N Ethers Derived from 2-Alkyl-4-oxy-5-nitroquinazolines and 2-Alkyl-4-keto-5-nitrodihydroquinazolines: M. T. BOGERT and H. A. SEIL.

Some Acyl Derivatives of Homoanthranilic Nitrile and the 7-Methyl-4-ketodihydroquinazolines Prepared Therefrom: M. T. BOGERT and A. HOFFMAN.

The Condensation of Succinylosuccinic Acid Diethyl Ester with Guanidine: A Derivative of 1, 3, 6, 8-Naphtotetrazine, a New Heterocycle: M. T. BOGERT and A. W. DOX.

The Methoxyl Group in Certain Lignocelluloses: ALVIN S. WHEELER.

Influence of Dilution and of the Presence of Lactose and Maltose upon the Osazone Test for Glucose: H. C. SHERMAN and R. H. WILLIAMS.

Some Further Notes on the Possible Existence of Esters of Fulminic Acid: H. C. BIDDLE.

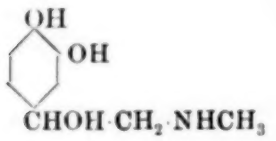
Some Condensation Products of 1-Phenylnaphthalene-2,3-dicarboxylic Anhydride: NORMAN A. DUBOIS.

On Monobromalkylketodihydroquinazolines: W. F. HAND and M. T. BOGERT.

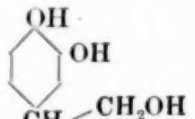
Some New Salts of the Nitrosulphobenzoic Acids: Edward Hart.

Adrenalin, the Active Principle of the Suprarenal Gland: T. B. Aldrich.

The formula $C_9H_{13}NO_3$, first proposed by the author, has been confirmed by various investigators. The structure, several details of which are certain, is possibly represented by one of the two following formulæ:



I.



II.

Compounds synthetically prepared on the lines of formula I. seem to be similar physiologically to adrenalin, but recent work by the author gives like evidence for II. The work is being continued.

The Efficiency of Copper Foil in Destroying Certain Bacteria in Water: W. H. Buhlig.

Several sets of experiments, made along the lines suggested by the recent work of Moore, show that at incubator temperature the typhoid bacillus disappears in a few hours in the presence of copper, but at room temperature, in hydrant water, it persists several days. In the case of the colon bacillus the copper treatment has little practical value, but the dysentery bacillus appears to yield quickly.

Colloidal Suspensions and their Relations to Problems in Water Purification: J. W. Ellms and J. F. Snell.

Turbid water show many of the properties of colloidal suspensions, *e. g.*, the Tyndall effect, migration of the turbidity under the influence of the electric current, coagulation by electrolytes, etc. A possible explanation of the mechanism of coagulation by sulphates of aluminum and iron is the formation of positively charged colloidal hydrates, which precipitate the negatively charged colloidal particles in the water. Experiments are in progress on the relative concentrations of colloidal suspensions and electrolytes required for precipitation and the influence of substances in retarding the coagulation.

The Composition of Cooked Foods: W. D. Bigelow.

Artificial Digestion Experiments: Edward Gudeman.

As the result of a large series of artificial digestion experiments with pepsin and pancreatin on egg albumen with reference to the interference of preservatives, colors, and condiments, the following conclusions are drawn: (*a*) Preservatives and condiments do not interfere with peptic and pancreatic artificial digestion when in the proportion of 1 part to 400 or less, in acid medium. (*b*) Acid preservatives and condiments increase the factor of digestibility in neutral medium. (*c*) In alkaline medium the results are abnormal, retarding the action of ferments. (*d*) Colors, irrespective of source or origin, whether animal, vegetable, mineral or synthetic, do not affect artificial digestion when used in quantities of 1 part or less to 400 parts of the food products. (*e*) Vegetable and synthetic colors are directly digested in the same proportions by pepsin and pancreatin and the actual food value of both classes is the same.

Notes on Occurrence of Pentosans in Second Pressing Cider: J. A. Le Clerc and L. M. Tolman.

Color Tests for Cod-liver Oil: W. D. Bigelow.

The Presence of Hexone Bases in Bacteria: Mary F. Leach.

Dried and pulverized bacteria belonging to the colon group were digested with thirty-three and one third per cent. sulphuric acid for several hours, until the pro-

teid was all decomposed. From the extract thus obtained, lysine was separated as picrate, and the picrate transposed into the chloride. Both salts were identical with the corresponding salts of lysine prepared from gelatin and from fibrin. Thus the presence of a hexone base in the bacterial cell has been established, and one more point of resemblance has been found between bacterial and other proteid.

The Testing of Wheat Flour for Commercial Purposes: HARRY SNYDER.

The points noted or discussed were: the lack of adequate standards for commercial testing of flour; the difficulty of adopting tests suitable to all types of flour; the influence of total proteids on size of loaf and commercial grade; the application and value of gliadin nitrogen determinations; the value of the ash results in determining the grade of a flour or in detecting the mixing of grades; the value of color in determining the commercial grade of a flour, and the influence of the bleaching of flours; and the relation of high bread-making value to nutritive value.

The joint use of baking and chemical tests was recommended. The chemical tests can determine the grade, as patent, straight or clear, while the baking tests can determine the bread-making value of the sample.

The Occurrence of Extractives in Apple Peel: H. C. GORE.

The Pectocelluloses of the Apple: W. D. BIGELOW and H. C. GORE.

The Analysis of Sugar Mixtures: C. A. BROWNE, JR. (By title.)

Chemical Preservatives Used in Food Products. Are They Harmful? E. W. DUCKWALL.

Attention was drawn to the difference between the effect of substances on the growth of bacteria and their effect on the action of digestive ferments.

Experiments have shown that salicylic and benzoic acids in strong solution do not impede peptic digestion more than other substances in a mixed diet, and that the feeding of these preservatives to guinea pigs and rabbits has no action on their growth or organs. It should be noted, however, that the duration of the trial was rather short, while the number of individual tests was small.

Recent Work on Columbium and Tantalum: R. D. HALL.

On the Oxidation of Hydrazine: A. W. BROWNE.

When a solution of hydrazine sulphate is treated with hydrogen peroxide, potassium chlorate, potassium persulphate, ammonium metavanadate or lead dioxide in acid solution, hydronitric acid is formed in very appreciable quantities.

In acid solution potassium permanganate and potassium dichromate oxidize hydrazine sulphate, forming in some cases a trace of hydronitric acid, in others, none at all.

Certain other oxidizing agents, including potassium iodate, bromine water and red lead, yield no hydronitric acid whatever.

The principal reaction involved in the oxidation of hydrazine sulphate is expressed by the equation:

$$N_2H_4 + 2O = N_2 + 2H_2O.$$

The equation for the reaction in which hydronitric acid is formed may be written

$$3N_2H_4 + 5O = 2HN_3 + 5H_2O.$$

The two reactions appear to take place simultaneously.

In the light of this work it is apparent that when an oxidizing agent is to be used in the quantitative determination of hydrazine, or when hydrazine sulphate is to be used in the quantitative determination of an oxidizing agent, care must be taken to

choose materials and arrange conditions, if possible, so that no hydronitric acid shall be formed.

The error introduced by the formation of a given amount of hydronitric acid will obviously be greater if the analysis consist in the measurement of the nitrogen gas evolved than if it consist in the determination of the unused excess of the oxidizing agent.

The Chemical Separation of the Radioactive Types of Matter in Thorium Compounds: Herman Schlundt and Richard B. Moore.

REPORTS FROM INSTITUTIONS.

This valuable feature was continued, thirteen institutions responding. It should be borne in mind that the following extremely condensed summaries of the reports of work in progress during the past year are, in most cases, far from exhaustive.

University of Pennsylvania.—Electrodeposition of lead and mercury from salts and metals, with the use of a rotating anode; also, deposition of cadmium from an ammonia solution, gold from cyanide solution, etc. Methods for complete analysis of alkali halides, etc., with the use of a mercury cathode and silver anode. Investigation of the compounds of columbium and tantalum.

Massachusetts Institute of Technology.—Electrical conductivity of aqueous solutions at high temperatures. Conductivity of fused salts. Ionization of the successive hydrogens of polybasic acids, as phosphoric, sulphuric and hydrogen sulphide. System of qualitative analysis including the rare elements (now completed in outline with the exception of the rare earth group). Separation of electropositive groups and study of the properties of the metal-ammoniums.

University of Wisconsin.—(In addition to work elsewhere reported on at this meeting.) Dielectric constants of oleic acid, oleates, etc. Difference of electrical potential between electrodes of the peroxides of lead and manganese and various solutions. Study of alloys of tin with zinc and with cadmium. Improved static method for measuring vapor tensions of solutions. Equilibrium in the system silver nitrate-pyridine. Numerous experiments on osmosis, the details of which will soon be published.

Johns Hopkins University.—Composition of hydrates formed in aqueous solutions by various electrolytes. Temperature coefficients of conductivity of various electrolytes. Condition of electrolytes in mixed solvents. Electrical method for the combustion of organic compounds. Osmotic pressure of cane sugar solutions. Electrolytic production of pure caustic alkalies. Rate of oxidation of various aromatic compounds by potassium permanganate. Chlorides of orthosulphobenzoic acid. Camphoroxalic acid derivatives. Pinacone-pinacoline rearrangement.

Harvard University.—Study of tetrabrom and of tetrachlor-orthoquinone. Bromine addition products of dimethylaniline. Atomic weights of sodium, cadmium, iodine and other elements. Compressibilities of elements and simple compounds. Electromotive effects; electrostenolysis. Action of potassium iodide on bromanil and chloranil. Action of phenyl hydrazine on various quinones. Action of ethylene dibromide on *p*-nitrosodialkylanilines. Oxidation of organic compounds by air in presence of catalyzers. Determination of phosphoric acid. Preparation of pure nitrogen on a large scale.

Lafayette College.—Salts of *m*- and *o*-nitroparasulphobenzoic acids. Salts of *m*-sulphonitrobenzoic acid. Constitution

of talc. Purification of titanic acid. Some non-aqueous concentration cells.

Ohio State University.—Synthesis of ortho-oxyazo compounds. Action of phosphoric and related acids in the production of esters. Gibbs's method for precipitating magnesium ammonium phosphate. Separation of calcium and magnesium. Apparatus for determining moisture in samples. Electrolytic separation of bismuth.

University of Chicago.—Dissociation phenomena in the sugar group. Constitution of dibromacetylidene. The various forms of liquids and amorphous sulphur. Catalytic action. Stereoisomeric nitrogen derivatives. Radioactivity of uranium compounds. Affinity constants of dibasic acids. The chlorides of manganese. Phenylmalonic nitrile.

Verbal reports were also made by representatives of Cornell University, University of Toronto, University of North Carolina, Columbia University, and the New York Testing Laboratory.

The local committee, of which John C. Miller was chairman, made ample provision for the entertainment of the society, and their services and those of the Buffalo Society of Natural Sciences (in whose rooms the chemical meetings were held), as well as the courtesies of several other local organizations, were recognized in a rising vote of thanks. Carriages were provided on Thursday afternoon for a drive about the city, and many members visited the Gratwick Research Laboratory, where a paper was presented entitled, 'On the Chemical Composition of a Series of Mouse Tumors,' by G. H. A. Clowes and W. S. Frisbie.

The chemical plants both in Buffalo and in Niagara Falls refused admittance, but Mr. Francis A. J. Fitzgerald delivered an interesting address on 'The Electrochemical Industries of Niagara Falls.' The subject was treated from an evolutionary point of view, and the effects of the struggle for existence and the influence of environment considered. In the Hall process for making aluminium the raw material bauxite is now purified by an electric furnace process, and the carbon electrodes baked in an electric furnace. The severe competition brought on in the abrasives market by carborundum has stimulated the production of other artificial abrasives such as 'alundum,' an artificial corundum made by fusing bauxite in the electric furnace. The production of artificial graphite was developed by the demand for graphite electrodes in the electrolytic processes for the production of chlorine, caustic soda, etc. While the problem of making nitric acid from the air has not yet reached the commercial stage, the spark discharge is used industrially for the production of ozonized air for the production of vanillin from oil of cloves. The manufacture of chlorine and caustic alkalies has grown greatly in the last ten years, consequently competition is severe and results in the invention of processes using chlorine gas for the manufacture of carbon tetrachloride, tin tetrachloride, etc. Seeking an outlet for sodium and sodium peroxide, the makers are putting new commercial products on the market, such as 'oxone' a fused form of sodium peroxide which generates oxygen when put in water, and various compounds such as magnesium peroxide, calcium peroxide, zinc peroxide and sodium perborate. Samples of many of the products mentioned in the address were exhibited, and oxygen was generated from oxone by a simple apparatus.

This address was given at the Iroquois Hotel, the headquarters of the meeting, and was followed by an informal luncheon served with the compliments of the hotel.

On Friday afternoon a large number of members availed themselves of a boat trip in the harbor on the city fire tugs, while others visited the soap plant of the Larkin Company. In the evening about eighty attended a subscription dinner at the Hotel Iroquois.

The whole of Saturday was devoted to an excursion to Niagara Falls. A visit to the Power House was followed by a luncheon given by the Natural Food Company, and this by a trip over the Gorge Route.

The total registration at the meeting was 178. The secretary, Dr. W. A. Noyes, announced that as the result of a mail vote with reference to the establishment of an abstract journal in cooperation with the Chemical Society of London and the Society of Chemical Industry, seventy-nine adverse votes had been cast out of a total of about 700 so far received. Four eminent scientists were elected honorary members of the society: Svanté Arrhenius, Walther Nernst, H. W. B. Roozeboom and Julius Thomsen.

The next meeting will be held at New Orleans, December 29 to January 1, 1905–6.

Austin M. Patterson.

SCIENTIFIC BOOKS.

A System of Metaphysics. By George Stuart Fullerton. New York, The Macmillan Company, 1904. Pp. x + 627. Price, $4.

Professor Fullerton makes in the work before us a very creditable attempt to be true to the promise of his title-page; he constantly bears in mind that he has set himself not merely to produce a series of essays on metaphysical subjects, but to set forth the whole scheme of his science in a complete and orderly manner. Only a reader who, like the present reviewer, has himself had occasion to do the same thing can fully appreciate the difficulties of such a task and the recognition fairly due to even a partially successful execution of it. Under Mr. Fullerton's hands the subject falls into four main divisions: Part I., 'The Content of Consciousness,' starting from the standpoint, assumed by the author to be that of psychology, of a world of experiences primarily given as states of the individual consciousness, aims at showing the unsatisfactory nature of such a general conception of the real, and the need for some more fundamental metaphysical interpretation of experience. Part II. discusses the 'external world' in a series of chapters devoted mainly to the doctrine of space and time, and concluding with a rather perfunctory defense of the conception of existence as a perfect mechanism against the 'descriptive' view of mechanical science championed by Kirchhof, Mach, James Ward and others. Part III., 'Mind and Matter,' deals at length, and with much acuteness, with the problem of the relation of mind and body, and contains, besides a very vigorous and damaging attack upon the subjective idealism which denies the reality of any knowledge of things as distinct from our own mental states, Professor Fullerton's own ingenious version of the doctrine of psychophysical parallelism. Finally in Part IV., 'Other Minds and the Realm of Minds,' the author deals with the traditional problems of the old rational psychology and natural theology. Speaking summarily, it may be said that Professor Fullerton's position in metaphysics is that of a critical realist. He holds, that is, that there is a real physical world of extra-mental objects, and that of that world we have a direct, and not merely a symbolic or representative, perception. Further, he maintains that the whole world of minds and bodies alike forms a complete and perfect mechanism, the relation between the bodily and mental aspects of it being a purely logical 'parallelism,' and consequently adopts a purely determinist view of moral action. Finally he so far follows in the footsteps of Kant as to regard the existence of God and the reality of a future life as matters beyond the limits of demonstrative science, but as affording scope for a legitimate exercise of faith.

It is hardly to be expected that the execution of so extensive a work should be equally

satisfactory in all its parts, and, speaking for myself, I can not but think the last two divisions of the book much superior to the two which precede them. The reason for the difference in value seems to be that the author is much more at home in the psychological problems with which these sections mainly deal than in the realm of pure logic and epistemology. Indeed, the very presence of Part I. might, perhaps, be regarded as an unfortunate mistake. The conception of the experienced world as consisting of 'states of consciousness' is not only in itself an absurdity, as Professor Fullerton himself shows conclusively, and not without humor, in the chapters of Part III. which deal with the doctrines of Clifford and Karl Pearson, but is an absurdity not likely to be entertained by the student except as the result of misguidance at the hands of a psychologizing metaphysician. Hence it seems a pity to start the reader off on a false scent for the purpose of afterwards demonstrating his error to him. Surely it would have been better to make a beginning with the 'naïve realism' which is habitual to all of us in our every-day life, and to assume from the first as a working hypothesis that we have a direct perception of objects which, whatever their nature, are to be carefully distinguished from the processes by which they are cognized.

The author's second part is, perhaps, the least satisfactory portion of the whole work. Mr. Fullerton is apparently quite unfamiliar with the indispensable foundation of any satisfactory doctrine of space and time, viz., the modern mathematical theory of infinity and continuity. Hence his attack upon the Kantian 'Aesthetik' inevitably becomes a very grave *ignoratio elenchi*. The real objection to the 'Aesthetik' is, of course, that no analysis of mathematical concepts can be adequate which fails to recognize that their application to space and time is logically a secondary affair, and requires to be preceded by the logical investigation of relations of number and order considered in complete abstraction from the special nature of the terms numbered and ordered. This fundamental point is ignored by the author, who prefers to furbish up old difficulties about motion which may puzzle the non-mathematical reader, but will be seen at once by those acquainted with the mere outlines of modern investigations into infinity and continuity to be idle fallacies, and that of a kind which, if sustained at all, must be fatal not merely to the special theories of Kant, but to the whole spatial and temporal scheme of mathematical physics. Mr. Fullerton himself attempts to find a way out of his own self-created difficulties by adopting Berkeley's analysis of space and time as perceived by the senses, but with the mental reservation that the space and time which are conditions of the existence of the real extramental world are just what the mathematical physicist declares them to be. He forgets that according to Berkeley there is no extramental world and, therefore, no such 'real' space or time, and that according to himself the infinitely divisible and continuous space and time of the physicist are full of logical contradictions and must, therefore, be purely unreal.

Even in the latter half of the work the writer does not seem to be by any means as successful on the constructive as on the destructive side. Thus, ingenious as his defense of 'parallelism' is, he nowhere seems to have given any more cogent reason for adopting a parallelistic rather than an interactionist position than the obvious reflection that interaction is inconsistent with a purely mechanical interpretation of the universe. But that any science really demands our acceptance of absolute mechanism as the truth about things is a statement which he makes no attempt to prove, nor does he show any real comprehension of the meaning of anti-mechanistic philosophers, or of the gravity of the difficulties which have to be faced by a relentless and consistent theory of pure mechanism. A reader who should take his notions on the subject from Mr. Fullerton's fifteenth chapter would, indeed, probably go away with the notion that Dr. Ward (and? Mach) is an unscientific and credulous person who thinks that after all there is 'nothing in' modern

mechanical science. There is, in fact, nothing that I for one desiderate more in Professor Fullerton's metaphysical structure than a serious and thorough discussion of the question, what are the real logical postulates of mechanical science, as distinguished from the mechanistic philosophy professed by some, but by no means all, men of science, and how far those postulates imply the belief that the actual course of any real process is through-and-through mechanical.

But the adequate discussion of this problem presupposes a much more searching critical analysis of the logical character of knowledge than Professor Fullerton has seen fit to undertake. One very important issue which such an analysis would raise would be the question whether an empirical realism, such as that successfully upheld by Professor Fullerton against the subjective idealist, does not admit, or possibly even demand, as its complement a further doctrine of critical or transcendental idealism.

A. E. Taylor.

SOCIETIES AND ACADEMIES.

THE NEW YORK SECTION OF THE AMERICAN CHEMICAL SOCIETY.

The last regular meeting of the New York Section of the American Chemical Society was held in the Assembly Hall of the Chemists' Club, 108 West 55th St., Friday, June 9, at 8:15 P.M. The chairman, Dr. Wm. J. Schieffelin, presided.

The reports of the secretary and treasurer for the year 1904–1905 were read and approved. The secretary's report showed a net gain in membership of the section of sixteen.

The program of the evening was as follows:

Some Condensation Products of 1 Phenyl-naphthalene-2-3-Dicarboxylic Anhydride: Norman A. Du Bois.

It was shown by Michael and Bucher that acetic anhydride and phenylpropiolic acid act upon each other to form a new compound, *a* phenylnaphthalene-dicarboxylic anhydride. The reaction is said to be practically quantitative. In preparing quantities of this compound for experimentation, a modification in the usual method for the preparation of phenylpropiolic acid was discovered by the writer. Formerly it was prepared from cinnamic acid by esterifying and brominating, and then boiling the cinnamic ethyl ester dibromide with alcoholic potash for eight hours. It was found that this long boiling was unnecessary and that as good a yield was obtained if the alcohol was distilled off immediately after dissolving the cinnamic ethyl ester dibromide.

The *a* phenyl-naphthalene-dicarboxylic anhydride can be condensed with resorcin in the presence of zinc chloride, to form a compound analogous to fluorescein. This fluorescein analogue, when treated with the theoretical quantity of bromine in glacial acetic acid forms a tetra bromo substitution product, analogous to eosin. Both of these compounds are direct dyes for animal fibers. The fluorescent analogue also forms iodine and chlorine substitution products.

The *a* phenyl-naphthalene-dicarboxylic anhydride can also be condensed with most other phenols to form condensation products analogous to those formed by phthalic anhydride.

On the Preparation of Hydrobromic and Hydriodic Acids: L. H. Friedburg.

Bromine is allowed to trickle into paraffin which is kept in a molten condition by placing the flask containing it in a shallow steam-bath. The bromine vapors which will pass over along with the hydrobromic acid, are partly absorbed by a second paraffin-containing flask, joined to the first and standing together with it in the water-bath.

The fact that iodine and paraffin, or better still, iodine and vaseline, will allow the production of hydriodic acid was a further novelty. Here the gas produced is not washed but simply passed through a big empty bulb-tube before allowing it to be absorbed by water.

Præseodymium Tetroxide: Charles Baskerville and J. B. Thorpe.

That which has been regarded as the tetroxide, Pr_2O_4, is a brownish-black substance resembling manganese dioxide in appearance and conduct with hydrochloric acid. It should rather be called the dioxide. By fusing this dioxide with sodium dioxide a yellow-

ish substance has been obtained which on analysis shows the formula $Pr_4O_4 \cdot H_2O$. This tetroxide is insoluble in water, but readily decomposed by acids, giving the normal salts of præseodymium.

On the Simplicity of Præseodymium: CHARLES BASKERVILLE and G. M. MACNIDER.

Unsuccessful efforts were made to fraction præseodymium by fractional precipitation at different temperatures with oxalic acid, fusion with sodium dioxide, fractional solution of the dioxide and tetroxide in hydrochloric acid. The fractionation was followed by an examination of solutions of uniform strength, acidity and amount by means of a Zeiss comparison spectrometer.

Artificial Willemite: CHARLES BASKERVILLE and A. BOURGOUGNON.

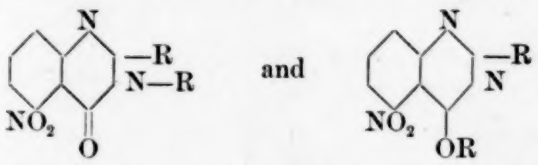
Artificial zinc ortho-silicate made of pure material neither fluoresces nor phosphoresces under the influence of the ultra-violet light. On the introduction of small amounts of manganese, bismuth and thorium various results were obtained. All of these bodies are phosphorescent; only that one containing the manganese is fluorescent.

The Production of Boron Carbide from Boric Oxide in the Electric Furnace: H. J. BLISS and S. A. TUCKER.

The extreme hardness of this substance might give it certain uses as an abrasive. The authors showed that it could be prepared directly from boric acid and coke in large quantities, whereas hitherto boron has been used for the preparation. The existence of Muplhauser's BC was shown to be extremely doubtful and is probably a mixture of graphite and B_6C.

Isomeric Ethers in the Qinazoline Group: H. A. SEIL and M. T. BOGERT.

The isomerism in this group depends on the migration of an imide hydrogen in the ortho position to a ketonic oxygen. The isomers are



The first was prepared by the action of NH_2R on the 6-nitro-acyl-anthranil. The second by heating the alkyl-hydrogen-quinazoline with potassium hydroxide and alkyl iodide in a bomb tube to 150° C. Both are crystalline solids soluble in hot alcohol. The ether melts at ten degrees lower than its isomeric quinazoline.

Acyl Derivatives of 4 Amino-methyl-phthalate: R. R. RENSHAW and M. T. BOGERT.

4 Amino-methyl-phthalate is readily obtained by the reduction of 4-nitro-methyl-phthalate. It crystallizes from alcohol and benzine in glistening plates. Acyl derivatives of this were prepared with mono and dibasic fatty acids, aromatic acids and substituted carbonic acids. These substances are well-defined, crystalline bodies, soluble in most organic solvents, nearly insoluble in water, ligrome and petroleum ethers.

The following officers were then elected for the year 1905–1906:

President—F. D. Dodge.
Vice-President—A. A. Breneman.
Secretary-Treasurer—F. H. Pough.
Executive Committee—Wm. J. Schieffelin, H. C. Sherman, Charles Baskerville and G. C. Stone.

F. H. POUGH,
Secretary.

DISCUSSION AND CORRESPONDENCE.

ON THE SPELLING OF 'CLON.'

IT is over two years[1] since Mr. H. J. Webber first proposed the word *clon* as the designation of horticultural groups of plants which are propagated exclusively by vegetative means. During this period of probation, as it were, the need for such a word has been amply demonstrated, and its formal adoption by the Association of Agricultural Colleges and Experiment Stations has placed it within the cognizance of lexicographers. No other word apparently exists which can properly be extended in meaning to cover the idea expressed by *clon;* and the purpose of the present writer is merely to suggest an improvement in orthography which seems to be demanded by both phonetic and philological considerations. One of the few definite indications of quantity in

[1] SCIENCE, N. S., **18**: 501–503, 1903.

English words is found in the final *e*, which always denotes the long sound of the preceding vowel, as in *tone, bite, hate,* etc. It is true that recent writers on botany have frequently attempted to simplify the spelling of technical terms to the detriment of phonetic principles, and so we have such forms as *mestom, plerom, hadrom,* etc., which must be admitted to our dictionaries as variants of the infinitely preferable *mestome, plerome, hadrome,* still employed by careful writers. The fact that there are two Greek words *κλών* and *κλόνος* (the latter giving us the English adjective *clonic*) merely emphasizes the importance of properly indicating the long *o* in English derivatives of *κλών*. I therefore suggest *clone* (plural *clones*) as the correct form of the word to be adopted in dictionaries, lexicons and general writings. It is to be hoped that the 'shackles of philology' to which Mr. Webber so feelingly refers will not prevent him from accepting this suggestion in the friendly spirit in which it is offered.

Charles Louis Pollard.

Springfield, Mass.

SPECIAL ARTICLES.

PRELIMINARY NOTE ON THE ARAUCARINEÆ.

In my paper on the megaspore-membrane of the Gymnosperms[1] a footnote refers to the occurrence of supernumerary nuclei in the pollen-tube of *Agathis*. Recently I have found that the number of nuclei in the pollen-tube of *Araucaria* may be even greater than that observed in the former genus, being over thirty in number in one instance at least. The supernumerary nuclei are placed fore and aft of the generative group in a parietal stratum of protoplasm not unlike that of the megaspore. Again the behavior of the pollen-tube in *Araucaria* is peculiar. The pollen-grains do not fall into the micropyle but are found at the distal end of the ligule more or less entangled in its serrated edge. From this point the tubes pass in grooves on the surface of the ligule or the scale, a distance of an inch or more, to the micropyle, which they enter and after penetrating the long beak of the nucellus arrive at the archegonia. This method of pollination and growth of the pollen-tube is unique among the Gymnosperms so far as is known and its bearing on the problems of fertilization important—notably on what may for convenience be termed the 'free-growth' theory of chalazogamy.

The double nature of the integument is very apparent in young ovules of *Agathis,* as Strasburger[2] long ago observed. The micropyle in some cases at least extends almost to the base of the nucellus on its upper surface, though usually not so far on the lower, in the form of V-shaped slits.

The archegonia are peculiar in structure arrangement and development. Their study is throwing new light on the character and relationship of these organs in the subgroups of the Conifers.

The vascular supply to the ovules worked out by series of celloidin sections is found to be different from the descriptions already given of it and promises very material aid in settling the vexed question of the primitive or specialized nature of the subgroup under consideration.

These features and other chiefly anatomical ones, added to the peculiarities presented by the megaspore-membrane and the tapetum, as described in the paper to which reference has been made above, place the Araucarineæ in a very isolated position among the subgroups of the Coniferæ. The forthcoming monograph, it is hoped, will make this clear and aid materially in the establishment of the phylogenetic position of the Araucarineæ.

Robert Boyd Thomson.

Biological Department,
University of Toronto,
June 20, 1905.

THE DEATH (?) OF AN AMŒBA.

While watching some amœbæ on February 8 I observed one which was behaving in a singular manner. Instead of progressing in

[1] 'The Megaspore-Membrane of the Gymnosperms,' by R. B. Thomson. University of Toronto Studies, Biological Series, No. 4, pp. 85–146, Pls. I.–V. 1905.

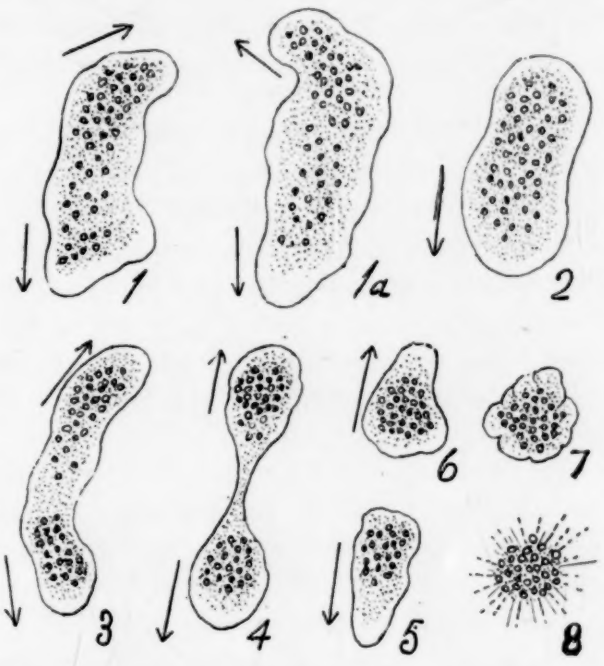
[2] Strasburger, E., 'Die Angiospermen und die Gymnospermen,' p. 91, 1879.

one direction this one appeared to be in a state of indecision. One end, which for convenience I shall call the anterior, was consistently trying to go in one direction. At the other end there was in progress an active formation of pseudopodia and an apparent endeavor to move in the opposite direction. The parenchyma of the amœba contained a rather larger amount of granular material than usual, and this was a little more abundant towards the posterior end.

The formation of pseudopodia at the posterior end was first in one direction (Fig. 1), and then in another (Fig. 1, *a*). This was accompanied by simultaneous formation of pseudopodia at the anterior end. The intracellular struggle which then ensued, during which the granular protoplasm flowed from the central region into both posterior and anterior pseudopodia, would continue for a few seconds, to be followed by the retraction of the pseudopodia and a few seconds of quiet. At last (Fig. 3), after two or three such trials, there appeared to ensue a determined struggle between the opposing ends of the animal. Soon the central portion became narrow and thread-like (Fig. 4). This connecting bond at last broke, and it was then seen that the animal had divided into two approximately equal parts. The part which had been the posterior region contained more than half of the coarse granules. The new individuals moved away from each other in opposite directions, each following the direction of its previous efforts. The one that had been the anterior end of the undivided animal not only contained fewer granules than the other, but it also had a larger proportion of clear protoplasm at its anterior end. It behaved normally and quickly moved out of the field. The other (Fig. 6), after moving in a normal manner for a few seconds, ceased to form pseudopodia, and assumed an irregularly spherical shape (Fig. 7).

Up to this point I supposed I had been witnessing an ordinary case of division. Then occurred what looked like the dissolution of this bit of supposedly immortal living substance. The ectosarc and protoplasm disappeared suddenly as if by a disruptive explosion, the larger globular granules remaining as an inert mass (Fig. 8).

It would appear that the posterior half of the original animal was too heavily charged with granular bodies. The ruptured surface probably failed to heal over. Rapid osmosis took place. The dense protoplasm increased in bulk rapidly until the ectosarc, no longer able to resist the pressure from within, gave way suddenly.



Sketches of a dividing amœba made from memory a few minutes after the events which they illustrate had been observed. 1, 1*a*, pseudopodia at opposite ends of the animal with energetic flow of the endosarc in opposite directions; 2, cessation of struggle, movement in only one direction; 3, renewal of struggle with elongation of animal; 4, beginning of division; 5 and 6, division completed, 5 normal, 6 abnormal new amœba; 7, position assumed by 6 a few seconds later; 8, spontaneous disruption of 7. No nucleus was seen.

There was sufficient vegetable debris present to keep the specimen from being crushed by the cover-glass.

No signs of life could be seen in the disintegrated part. It was simply a cluster of granules with no coherence and no connecting material.

The length of the undivided animal was about 0.03 millimeter. Several other amœbæ

of the same size and appearance were observed in the culture, but none were seen behaving in an abnormal way. As I did not realize that I had been witnessing anything unusual until the final catastrophe, the time occupied by the division and the subsequent events up to the disruption of the short-lived half was not noted. The whole operation lasted but a short time, probably little longer than one minute.

EDWIN LINTON.

HOMING OF FISSURELLA AND SIPHONARIA.

The *Patella* is the only mollusc whose homing powers have been investigated. *Fissurella,* a rhipidoglossate prosobranch, and *Siphonaria,* which stands on the border line between the opisthobranchs and the pulmonates, while differing more or less widely from *Patella* in structure, closely resembles it in the form of the shell and in their littoral habits. It was, therefore, an interesting question whether they resemble it also in the possession of the homing power. A stay at the Bermuda biological station in the summer of 1903 gave an opportunity to answer this question, although a few days only being available for the investigation, it was by no means as complete as could be wished. Such as it is, however, I present it for the benefit of future students of the subject.

The specimens studied were *Siphonaria alternata* Say and *Fissurella barbadensis* Gmelin.[1] Both are abundant at Bermuda, where they live clinging to the exposed faces of the bare rocks between tide marks. Bare rocks, I say, for to a New England eye one of the most striking features of the Bermuda coast is the entire absence of the larger algæ, which upon our own rocky shores shelter so large and varied a fauna. The rocks are calcareous, soft and of irregular surface and the home of *Siphonaria* is recognizable by a greenish spot where the foot has rested. That of *Fissurella,* as my notes show, is also clearly marked, though I have carelessly omitted to note how it may be known. Both species, as will be seen from the following notes, exhibit undoubted though limited homing powers.

[1] These specimens were kindly identified for me by Mr. Charles W. Johnson of Boston.

In marking animals and scars Higgins's water-proof ink was used. White paint, which was used by Davis, was not accessible, but as the ink marks last about three days they are fairly satisfactory. *Siphonaria,* being comparatively small, was readily removed from its scar; *Fissurella* I was seldom able to detach uninjured, and, accordingly, my observations upon this species were limited almost entirely to watching its voluntary departures and returns. As might be anticipated, the animals, unlike *Patella,* remain motionless on their scars during low tide, moving, if at all, only when the incoming water has moistened and cooled their immediate surroundings.

Siphonarias did not home when removed to a distance of more than six inches and were most likely to return when removed not more than two inches. A quiet and shallow tide-pool furnished the most favorable conditions for their return. If the animal, on being transferred, was set down with its head away from the scar, it turned in the proper direction and, so far as I could judge, those headed away were quite as likely to get back as those headed toward the scars. In general, animals which lost their way seemed to crawl restlessly about for two or three days; each time one was visited it was found in a new place. One, however, settled down at once in a new home and at the end of the third day had made a discolored spot. On being transferred to his old home he apparently failed to recognize it and immediately crawled away. Usually the scar was recognized at once by a returning wanderer, and on reaching its edge he would turn about, if necessary, so that his shell might fit the scar, would slip on to it and settle down. *Siphonaria alternata* thus appears to have a sense of direction, the ability to recognize its own recently-left scar, and the power of homing when removed not more than six inches.

Experiments with *Fissurella,* as I have said, were usually unsuccessful. That these molluscs have the power of homing is seen, however, by watching them. As soon as the tide has so covered him that he is not exposed to the wash of the waves a *Fissurella* is very

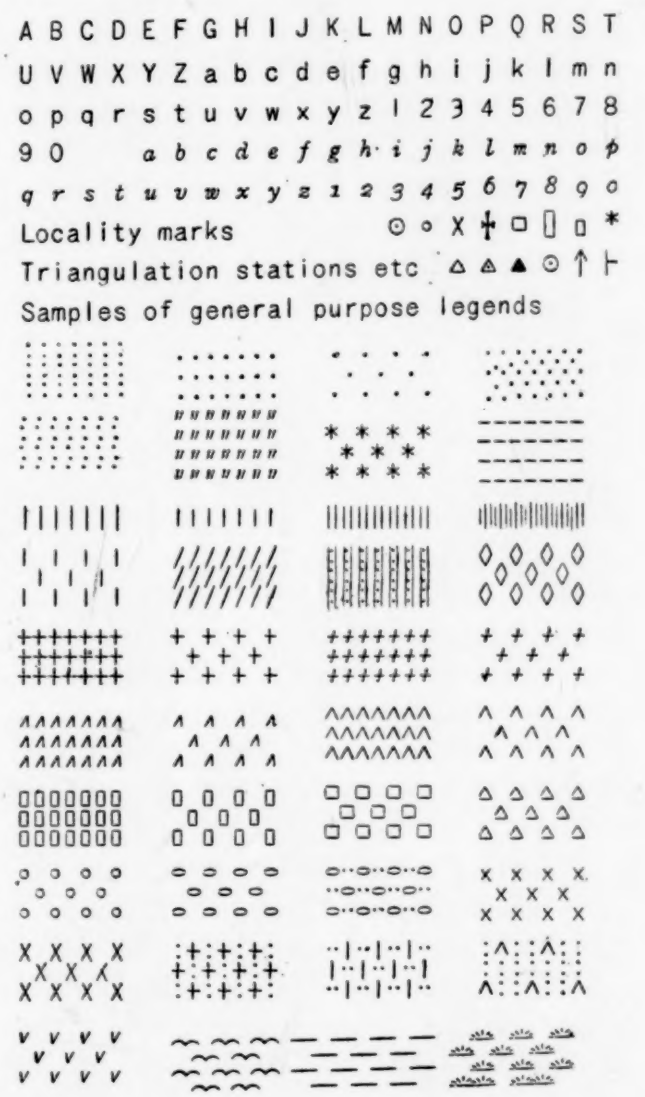
likely to start on a brief journey, going only about two inches from the edge of his scar, and returning to settle upon it again, sometimes within fifteen minutes from the time of his leaving it. In no experiment did I find a *Fissurella* homing if he had been removed more than three inches, though one which had been removed six and a half inches was nearly half way back in twenty-four hours. My departure from Bermuda prevented my learning his final fate. *Fissurella,* like *Siphonaria,* recognizes his scar and orients himself properly with reference to it as soon as he reaches it. In one instance I found a scar occupied by two animals; one was the owner, who had evidently returned from his wanderings to find that a usurper had already taken possession of half of his home. He had, however, crawled on to as much of the scar as was still unoccupied and the next day was in sole possession, while the intruder had disappeared. *Fissurella barbadensis,* then, undertakes short voluntary excursions and returns to his scar, but his power of homing when removed by some one else has not been fully tested.

M. A. WILLCOX.

MACHINE-MADE LINE DRAWINGS FOR THE ILLUSTRATION OF SCIENTIFIC PAPERS.

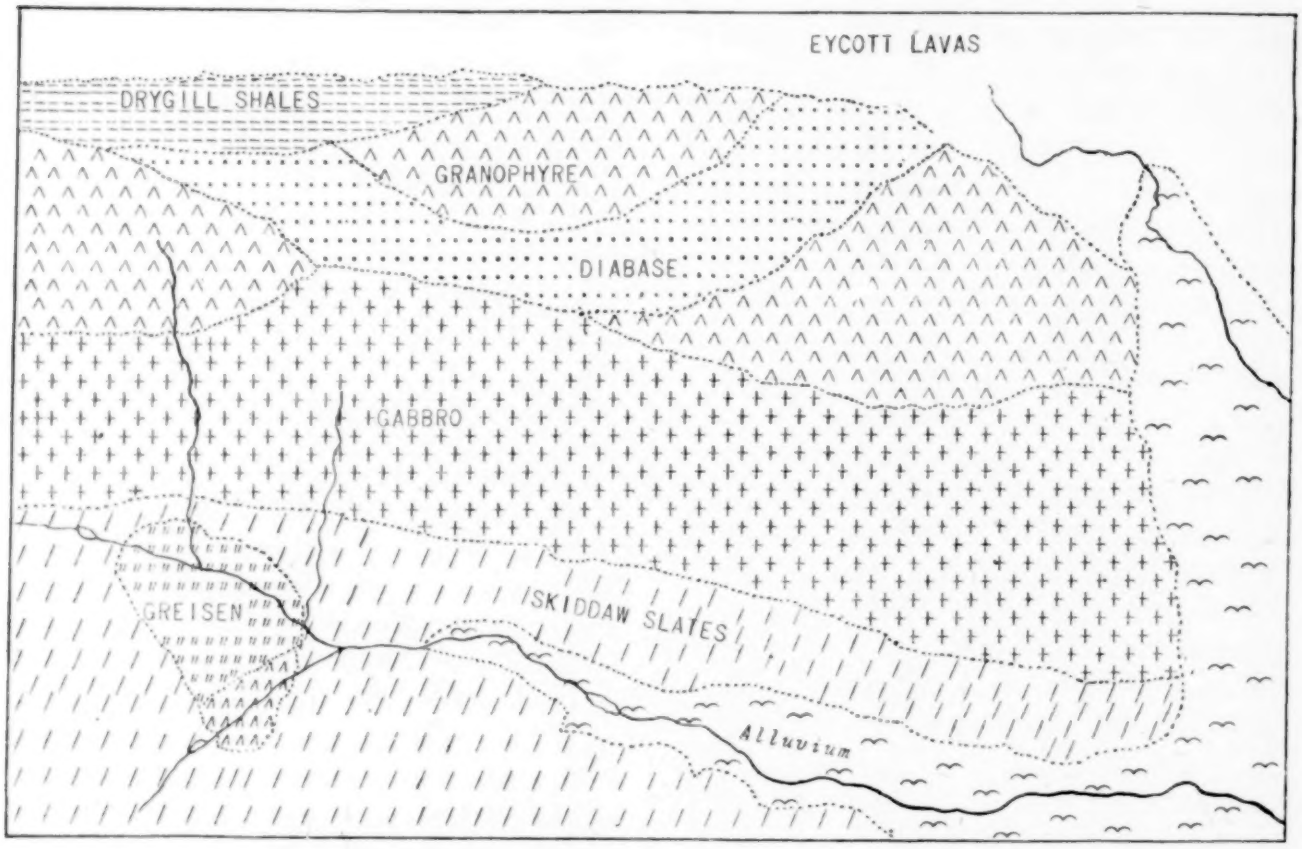
IT is safe to say that the majority of persons who from time to time publish scientific papers are seriously hampered in the preparation of text illustrations by the difficulty and expense entailed in the tedious drawing of map, section or diagram. Comparatively few authors can command the services of skilled draughtsmen or have themselves the requisite training to produce satisfactory line drawings. Yet the desirability of greatly increasing the proportion of such illustration in the thousands of scientific articles published each year is manifest. That clearness, precision and conciseness in the exposition of a theme are generally enhanced by the use of abundant, appropriate diagrams is as evident as that the blackboard is the constant friend of the teacher of any branch of natural history or philosophy; the printed page needs its blackboard.

Ideally, the author should himself be able to make the original drawing quickly, neatly and artistically. The usual execution of drawing with the pen is, to the average author, discouragingly slow and expensive, not always neat, and still less often artistic. The following note relates to some experiments made to increase rapidity and neatness in the production of line drawings by the use of a machine. At the outset the experiments were,



for obvious reasons, planned without any idea of rivaling the artistic work of the pen in a skilled hand. The aim has been to secure economy of time in execution and clear-cut precision of legend for the drawing. In both these respects enough success has been attained to warrant the recommendation of the machine method to geologists, geographers and others who desire to prepare useful text

illustrations at a minimum cost of labor. Some essays of the kind were made and published in the *Bulletin* of the Museum of Comparative Zoology at Harvard College, Vol. XXXVIII., 1902, Pls. 11, 12 and 13, in the *Amer. Jour. of Science,* August, 1903, pp. 118 and 120, and in the *American Geologist,* August, 1903, p. 66. The machine there used was an ordinary Underwood typewriter easily and quickly applied cross-hatchings, etc., made with an ordinary drawing pen. In complex diagrams free-hand work may generally be expected to supplement the work of the machine. The subject of each diagram should thus be studied with the end of securing suitable contrasts of legend along with the maximum economy of pen work; yet some pen work is almost always necessary.



fitted with a black record silk ribbon. Recently the Hammond Typewriter Company of New York has constructed, from the writer's specifications, a typewriter provided with a carbon ribbon and with ninety special characters designed for the preparation of line drawings to accompany geological and geographical papers. The same machine can be similarly used for statistical, engineering and other diagrams of a more or less mechanical and simple composition. Of course, this method should not wholly replace the use of the pen even, for example, in the differentiation of areas in a geological map or section. The ultra mechanical look of the typewritten legend can often be pleasingly relieved by the

The typewriter has its most general application in lettering, that most difficult element in line drawings. The particular machine made by the Hammond Company has the advantage of making it possible to employ a great range of type styles. Using the carbon ribbon, the writer has found that any one of the one hundred and twenty-five shuttles made for the machine (each shuttle bearing ninety characters and including the lettering for one of twenty-six different languages), will give an impression suitable for photographic reproduction. Each shuttle can be placed in the machine ready for work in a few seconds. The shuttles now on the market cost $2.50 each and any new character can be supplied

by the company at the cost of fifty cents. The ordinary Hammond machine furnished with a back-spacing key can be used for manuscript diagrams up to about eight inches in diameter, but the machine No. 6, fitted with a sixteen-inch roll, permits of the preparation of diagrams fourteen inches in diameter. The usual silk ribbon gives a 'woolly' line and is far less satisfactory than the carbon ribbon. A highly calendered and high grade linen paper of medium to heavy weight, or a thin Bristol board may be recommended. Often more than one impression of the key is necessary to obtain the required depth of tint for photography; such repeated impressions can be made at great speed by employing the back-spacing key. Care must be taken not to smudge the carbon of the completed printing.

The accompanying cuts serve to show something of the method as applied to geological diagrams. The diagram of alphabets and legends has been reduced to three fourths of its original diameters. The legends are intended to represent a few examples of those possible with the machine. They can be indefinitely increased in number and varied in design by the engraving of new characters on the shuttle and by using various permutations and combinations of the existing characters. The map is reduced to two thirds of its original diameters. It was copied from Harker's sketch map of the Carrock Fell District, published in the *Quarterly Journal of the Geological Society of London,* Vol. 51, 1895, Pl. IV. Here the geological formations could have been yet more clearly differentiated by cross-hatching with the ruling pen for one of them, but this particular drawing was made to illustrate the neatness and clearness of the machine-made production rather than to illustrate an ideal diagram. So far as the typewritten part of the 'drawings' is concerned, the use of the machine in preparing these illustrations represents a saving of from seventy-five to ninety per cent. of the time required by a draughtsman to duplicate the 'drawing.'

R. A DALY.
INTERNATIONAL BOUNDARY COMMISSION,
OTTAWA, CAN.

MEETING OF THE BRITISH ASSOCIATION IN SOUTH AFRICA.[1]

THE arrangements for the forthcoming meeting of the British Association in South Africa have now been completed, and Mr. Silva White, the assistant secretary of the association, sailed for Cape Town in the *Walmer Castle,* on Saturday last, July 1. The number of members who will proceed to South Africa to attend the meeting is 385, and of these no less than 276 members have intimated their intention to visit the Victoria Falls at the conclusion of the ordinary work of the association. The official party, consisting of leading representatives of science and guests of the association, with the general and sectional officers for this meeting and the president, numbers 140 in all, and will sail by the *Saxon* on July 29. Most of the other members will proceed to the meeting by the *Durham Castle* and the *Kildonan Castle,* both of which sail on July 22.

There will be receptions and social functions, excursions, etc., at Cape Town, Durham, Pietermaritzburg, Johannesburg, Kimberley and Bulawayo. The central organizing committee for South Africa (chairman, Sir David Gill, K.C.B., F.R.S., hon. secretary, Dr. Gilchrist) has carried out the coordinating work of the program. The lists of local committees and subcommittees contain nearly one thousand names, from which it may be concluded that much interest is taken in the meeting.

Lectures of a popular character will be delivered at the chief towns visited. These lectures have now been definitely arranged as follows:

Cape Town: 'W. J. Burchell's Discoveries in South Africa,' Professor Poulton; 'Some Surface Actions of Fluids,' Mr. C. V. Boys. *Durban:* 'Mountains: the Highest Himalaya,' Mr. D. Freshfield. *Pietermaritzburg:* 'Sleeping-sickness,' Colonel D. Bruce. *Johannesburg:* 'Distribution of Power,' Professor Ayrton; 'Steel as an Igneous Rock,' Professor Arnold. *Pretoria:* 'Fly-borne Diseases, Malaria, Sleeping-sickness, etc.,' Mr. A. E. Shipley. *Bloemfontein:* 'The Milky Way and the Clouds of Magellan,' Mr. A. R. Hinks.

[1] From *Nature.*

Kimberley: 'Diamonds,' Sir William Crookes; 'Bearing of Engineering on Mining,' Professor Porter. *Bulawayo:* 'Zimbabwe,' Mr. Randall-MacIver.

The president's address to the association will be delivered at Cape Town, on August 15, and at Johannesburg, on August 30. Mr. G. W. Lamplugh's report on the geology of the Victoria Falls will take the form of an afternoon address to Section C at Johannesburg.

SCIENTIFIC NOTES AND NEWS.

The American Medical Association met last week in Portland, Ore., with an attendance of about 1,500 members. Dr. Louis S. McMurtrie, of Louisville, Ky., delivered the presidential address, taking as his subject 'The American Medical Association, its Origin, Progress and Purpose.'

M. Curie has been elected a member of the Paris Academy of Sciences.

Dr. Adolf Wullner, of Aachen, has been made an honorary doctor of engineering by the Technical Institute of Dantzig.

M. Combes, recently premier of France, has returned to the practise of medicine in his native village.

The steamship *Roosevelt,* which will carry Commander R. E. Peary to the Arctic regions, sailed from New York City on July 16.

Professor W. M. Davis, of Harvard University, sailed from New York, July 15, for England, to accompany the British Association to South Africa. The party will leave Southampton on July 29, and return in mid-October.

The De Morgan medal of the London Mathematical Society has been awarded to Dr. H. F. Baker, F.R.S.

The Bissett-Hawkins gold medal of the Royal College of Physicians has been presented to Sir Patrick Manson for the services he has rendered to science and humanity by his researches on tropical diseases.

The Senn medal of the American Medical Association for an essay on some surgical topic has been awarded to Dr. John L. Yates, of Chicago.

The British Meteorological Office, which corresponds to our Weather Bureau, has been reorganized, and placed under the charge of a committee. The appropriations for the service is £15,300, and the salary of the director is £1,000. The committee is as follows: Mr. W. N. Shaw, Sc.D., F.R.S., director; Captain Arthur M. Field, R.N., hydrographer to the navy; Captain A. J. G. Chalmers, professional officer of the Marine Department, Board of Trade; Mr. W. Somerville, Sc.D., assistant secretary of the Board of Agriculture and Fisheries; Professor G. H. Darwin, F.R.S., University of Cambridge; Professor Arthur Schuster, F.R.S., University of Manchester; Mr. G. L. Barstow, nominated by the Treasury.

Among those who are the recipients of the king's birthday honors *Nature* notices the following: Lord Rayleigh, O.M., F.R.S., has been made a privy councilor; knighthoods have been conferred upon Professor T. McCall Anderson, of the University of Glasgow; Mr. E. W. Brabrook, C.B., formerly registrar of Friendly Societies; Dr. A. B. W. Kennedy, F.R.S., emeritus professor of engineering and mechanical technology at University College, London, and president of the admiralty committee on machinery designs; Dr. Boverton Redwood; and Dr. W. J. Smyly, president of the Royal College of Physicians, Ireland. Colonel D. Bruce, F.R.S., has been made a Knight Commander of the Bath. Dr. W. T. Prout, principal medical officer, colony of Sierra Leone, and Dr. J. W. Robertson, late commissioner of agriculture and dairying of the Dominion of Canda, have been made C.M.G.'s. The honor of Knight Bachelor has been conferred upon Dr. E. S. Stevenson, member of the medical council of the Cape of Good Hope; and Mr. Philip Watts, F.R.S., director of naval construction, is made an ordinary member of the civil division of the second division, or Knight Commander, of the Order of the Bath.

Students of Sibley College, Cornell University, have ordered designs made for a bronze tablet, which they will erect in memory of the late Dr. R. H. Thurston, formerly director of the college. The tablet is being designed

by Professor H. S. Gutsall, of the College of Architecture, and will be erected in a stone niche of the new Thurston Hall of Engineering, now in process of construction.

A BUST of the electrical inventor, Charles J. Van Depoele, has been placed in the Lynn Public Library.

MR. ROLLO APPLEYARD has presented to the Royal Institution a portrait of the late Professor J. D. Everett, the physicist.

DR. EDWARD STICKNEY WOOD, since 1876 professor of chemistry in the Harvard Medical School, died on July 11, at the age of fifty-nine years.

DR. J. M. CUNNINGHAM, formerly surgeon-general of India, has died at the age of seventy-one years.

DR. HERMANN VON WISSMANN, the African explorer, has died at the age of fifty-one years.

PROFESSOR HERMANN NOTHNAGEL, professor of clinical medicine in Berlin, and an eminent authority on the subject, died on July 7, at the age of sixty-four years.

PROFESSOR VON MILULICZ, professor of surgery at Breslau, and surgeon-general of the Prussian army, died on June 14.

PROFESSOR JACQUES ELISÉE RECLUS, professor of geography at the new University of Brussels, has died at the age of eighty-five years.

THE U. S. National Museum is about to receive a large collection of South American moths, the gift of Mr. Wm. Schaus, of Twickenham, England, and New York. This is one of the finest collections from this region extant, containing some 60,000 specimens and hundreds of types, mostly the result of Mr. Schaus's personal collecting.

THE west pavilion of the stone building, known during the Louisiana Purchase Exposition as the Palace of Fine Arts, was formally opened on July 1 to the public as the St. Louis Museum, embracing in the thirty-six rooms, collections of exhibits from forty different countries, valued collectively at $500,000.

WE learn from the *Electrical World* that the United Engineering Building Committee voted a contract last week for $795,000 to the Wells Brothers Company, of New York City, for the construction of the new building under the Carnegie gift, on West Thirty-ninth Street, New York. This contract does not include anything for electrical plant, wiring, steam heating, etc., but deals solely with the construction of the edifice. The lots have already been excavated, and work will begin without delay. October, 1906, is spoken of as the time of completion and readiness.

DEARBORN OBSERVATORY at Northwestern University was damaged by fire on July 15 to the extent of $1,000. None of the instruments was harmed.

THE Bureau of Forestry, to which the control of the national forest reserves have been transferred, will hereafter be known as the forest service.

IT is stated in the *Electrical World* that a conference has been called by the Reichsanstalt as a preliminary to the meeting of the International Commission on Electrical Units and Standards. To this conference the Reichsanstalt has invited the heads of bureaus in America, England, Belgium, Austria-Hungary, also Lord Rayleigh, Professors Kohlrausch, M. Mascart and Carhart, of the University of Michigan. The conference will be held in Berlin, probably the latter part of October, the exact date not having as yet been fixed. It seems probable that the commission will be called together within the next two years.

AT a meeting of a number of members of Parliament on July 4, the following resolution was unanimously passed: "That this meeting, being satisfied of the necessity of further state aid to the National Physical Laboratory, at Teddington, as regards both equipment and maintenance, requests the chairman and conveners of this meeting to prepare and present a memorial to the chancellor of the Exchequer asking for such additional aid, and that the memorial be signed by members here present or who, being absent, may be in sympathy with its objects."

THE University of Colorado, at Boulder, has been able to acquire, through the gener-

osity of Hon. Simon Guggenheim, of Denver, a large collection of birds' eggs and nests gathered by the late Dennis Gale, of Boulder. The collection embraces eggs of nearly all the species known in the vicinity of the university, and in many cases there are specimens taken from nests at six or more different altitudes. The collection also contains many nests from the sub-alpine and alpine districts which are seldom found in museums.

UNIVERSITY AND EDUCATIONAL NEWS.

The temporary building occupied by the veterinary department of the University of Pennsylvania was destroyed by fire on July 6, entailing a loss of upward of $10,000. The university authorities are about to construct a building for the veterinary department at a cost of $200,000.

The University of Illinois has organized a School of Education, the purpose of which is to provide for special preparation of three classes of workers in the public school system, namely, first, the high school teacher, including the high school principal; second, the supervisor of special subjects, such as manual training, domestic science, music, drawing and physical training, and third, the school superintendent. The director of the school is Dr. Edwin Grant Dexter, and the faculty includes thirty-one instructors of various academic ranks. Besides this, the five normal school presidents of the state, together with Hon. Alfred Bayliss, state superintendent of public instruction, constitute a board of special lecturers, who, during the year, will discuss at the university topics of educational interest.

The University of Southern California, at Los Angeles, has begun the erection of a two-story north wing and a similar south wing to the building used by the College of Liberal Arts. The improvements will cost about $50,000. The north wing will be devoted mainly to the biological sciences. It will add 110 feet of north light to the present laboratories and comprises a zoological laboratory, 45 x 34 ft.; a laboratory for physiology and bacteriology, 46 x 26 ft., and a botanical laboratory, 45 x 30 ft. Besides these there will be a special laboratory 16 x 13 ft., an office, and a lecture room with a seating capacity of 200. Apparatus costing about $2,000 will be added to the present equipment. The south wing will be equipped in a similar manner for the departments of chemistry and physics.

The daily papers state that Attorney-General Mayer has decided to bring an action to deprive Cornell University of 30,000 acres of timber land between Tupper and Upper Saranac Lakes, in the Adirondacks. He will endeavor also to break a contract whereby Cornell has permitted the Brooklyn Cooperage Company to cut timber on the tract. This tract was purchased by Cornell with $165,000 out of an appropriation of $500,000 made by the legislature of 1898 for a forestry experiment, to last thirty years. Governor Odell in 1903 declined to permit any more money to go out for the experiment, and that came to an end.

Dr. Nicholas Senn has been elected professor of surgery in the University of Chicago.

Professor H. B. Dates, dean of the engineering school of the University of Colorado, has accepted a professorship of electrical engineering at the Case School of Applied Sciences.

Mr. Charles Brooks, assistant in botany in the University of Missouri, has been appointed instructor in botany in the College of Agriculture of New Hampshire.

Dr. William I. Chamberlain, president of the Arcot Mission College in India, has accepted the chair of logic and mental philosophy in Rugers College.

Miss Ann Rebecca Torrence, for the past two years assistant in botany in Wellesley College, has been appointed supervisor of the fifth and sixth grades and teacher of nature study in the State Normal School, New Paltz, New York.

Dr. Eugen Grandmougin has been appointed professor of chemistry in the Polytechnic Institute of Zurich in the room of Professor E. Bamberger, who has retired, owing to ill-health.